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COMMONWEALTH OF AUSTRALIA

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Complete Specification entitled (54) GRAIN DRYER.

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Related Art (56)

158,265(16,110/53)	32.7; 34.3; 17.5.
165,832(19,796/53)	32.7; 90.9.
150,422(32,807/50)	34.3; 17.5; 32.7.

The following statement is a full description of this invention, including the best method of performing it known to me:

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This invention relates to batch type grain dryers of the kind used to reduce the moisture content of grain as cropped prior to milling or other treatment of it.

Known batch drying arrangements have involved storing large quantities of the moist grain in silos having an inverted conical floor. The floor is perforated and air is pumped through it into the silo for escape upwardly through the grain. A disadvantage of this procedure is that the bottom grain is dried first and at least some of the moisture taken from it condenses on grain in the upper parts of the silo. This is not only inefficient but frequently results in the bottom grain becoming over-dry before the moisture level in the upper grain is reduced to a satisfactory figure. When the grain is drawn from the silo by opening an outlet at the bottom of its conical floor a flow pattern is established within the grain such that grain from the upper levels funnels downwardly through the mass of grain and is discharged along with grain from the lower levels; thus requiring grain in the upper levels to be brought down to the requisite moisture content, with consequent excessive drying of lower grain, before any substantial quantity of grain can be taken from the silo.

Another disadvantage of the prior art is that the depth of the grain in the silo usually varies due, on the one hand, to the inverted conical floor of the silo and, on the other hand, to the heaped upper surface of the grain which occurs if the grain is fed into the silo through a central point in its roof as is customary. Such variation of depth of the mass of grain in the silo causes non-uniform air-flow throughout the mass of grain which, in turn, produces uneven drying.

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In attempts to overcome the above indicated deficiencies of prior known batch procedures it has been proposed to dry grain by a continuous process wherein the grain to be dried descends between two perforated walls through a cross-stream of air entering through one wall and departing through the other. Hitherto, the apparatus, for continuous drying has comprised complex auger-type inlet and outlet conveyors whereby the grain is fed into the space between the walls and removed in a manner maintaining a substantially constant flow rate at all points between the walls. Those inlet and outlet devices are expensive and, in addition, expensive structural components are required to support the two walls against the pressure of grain between them.

With the foregoing in mind, an object of the present invention is to overcome the above indicated deficiencies in prior known apparatus and methods for drying grain.

According to one aspect of the inveption, it consists in a batch type grain dryer comprising a grain holder, air supply means which in use pass a stream of air through said holder in a downward direction, a grain outlet at or near the bottom of said holder, and a grain distributor which in use feeds grain to be dried into said holder in a manner producing a substantially uniform depth of grain in said holder, said stream of air passing through and in contact with the grain to dry etc.

According to preferred embodiments of the above described batch type dryer of the invention, the grain holder is a cylindrical silo with an inverted conical air-pervious floor such that the angle of inclination of the floor at all points corresponds to the natural angle of respose of the grain to be dried, that is to say, the angle to the horizontal

adopted by the free surface of a mound of such grain, and the grain distributor feeds the grain into the silo in a substantially even manner about the circumference thereof so that the top surface of the grain in the silo adopts an inverted conical shape conforming with the shape of the floor of the silo.

The grain distributor of grain dryers according to the invention is preferably in the nature of a multi-vaned windmill mounted for rotation about a vertical axis and adapted to be rotated by the incoming stream of drying air or by an electric motor. For preference, the vanes of the windmill are inclined downwardly and at least one of them is hollow or is otherwise adapted to feed grain deposited on the centre of the windmill to the radially outer end of the vane for discharge in an even manner at the periphery of the windmill.

By way of example, an embodiment of the above described invention is described hereinafter with reference to the accompanying drawings.

Figure 1 is a sectional elevation of a batch type grain dryer according to the invention.

Figure 2 is a sectional plan view taken on line 2-2 of Figure 1.

The illustrated grain dryer includes a grain holder 3 comprising a fabricated steel silo having a cylindrical outer wall 4, an inverted conical air-pervious, but grain impervious, floor 5 and a roof 6, all supported upon three equally spaced apart legs 7.

The grain holder is provided with a conventional bottom grain outlet 8 comprising an outlet chute 9 and a pivotally mounted gate 10.

A grain distributor is provided comprising a hub 11

with three downwardly inclined radially directed hollow arms 12 projecting therefrom. Each of the arms 12 projects from the hub 11 to a point adjacent the upper end of the cylindrical wall 4. The hub 11 is mounted for rotation upon a distributor shaft 13 within bearings 14 disposed within an input chute 15 provided with weather-proof removable lid 16.

Air supply means are provided comprising a motor driven fan 17 feeding an air duct 18 which enters the holder through the roof 16 at a point to one side of the axis of rotation of the grain distributor so as to produce a slow speed vortex under the roof 6 which acts upon the arms 12 to cause rotation of the grain distributor. Subsequently, the air flows downwardly within the holder 3 for eventual escape through the floor 5 as indicated by the arrows in Figure 1.

It will be apparent from the foregoing that grain fed into the holder 3 through the input chute 15 will be discharged from the tips of the arms 12 to fall towards the floor 5 adjacent to the periphery thereof. Thus, the charge of grain built-up in the holder 3 is established with an inverted conical surface 19 at an angle to the horizontal equal to the natural angle of repose of the grain. As the floor 5 is similarly inclined the depth of grain at all points in the charge of grain is substantially constant.

As indicated earlier, in silos or similar grain-holders grain from the upper levels funnels downwardly through the mass of grain near the centre of that mass when grain is being discharged.

Thus, it is possible for upper level grain which has been dried rapidly in a dryer according to the invention to become moistened by contact with moist grain at lower levels in the grain holder during discharge.

Therefore, an important feature of the illustrated dryer is the provision of an air pervious duct extending upwardly from a point just above the centre of the floor 5 to the air space above the grain. Such an air duct releases air liberally into the grain adjacent to it, thereby to establish a relatively dry annular column of grain about it in about the same time as it takes for the dryer to dry the upper levels of the grain.

Thus, discharge of grain may commence before the entire mass has been dried without the dry grain contacting wet grain.

A further advantage of such a central air duct 20 is that it ensures a full exposure of grain to be discharged to the drying air immediately prior to discharge, thereby enhancing the drying action when and where it is most needed.

The claims defining the invention are as follows:-

1. A batch type grain dryer comprising a grain holder, air supply means which, in use, pass a stream of air through said holder in a downward direction, a grain outlet at or near the bottom of said holder, and a grain distributor which, in use, feeds grain to be dried into said holder in a manner producing a substantially uniform depth of grain in said holder, said stream of air passing through and in contact with the grain to dry it.

2. A grain dryer according to claim 1 wherein said holder is a cylindrical silo with its axis substantially vertical and having an inverted concial air-pervious floor such that the angle of inclination of the floor is substantially the same as the natural angle of repose of the grain to be dried.

3. A grain dryer according to claim 2 wherein said grain distributor comprises a hub mounted for rotation about an upright axis coincident with that of said holder, a plurality of hollow arms extending downwardly from and radially outwardly of said hub to positions adjacent to the upper edge of the wall of said silo, drive means to rotate said hub and arms and means to feed grain to be dried into said hub for discharge through said arms.

4. A grain dryer according to claim 3 wherein said arms also consitute said drive means in that they are adapted to function as windmill vanes to cause said rotation by the inter-action of the arms with the steam of drying air.

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5. A batch type grain dryer substantially as described herein with reference to the accompanying drawings.

DATED this 2nd day of December, 1969.

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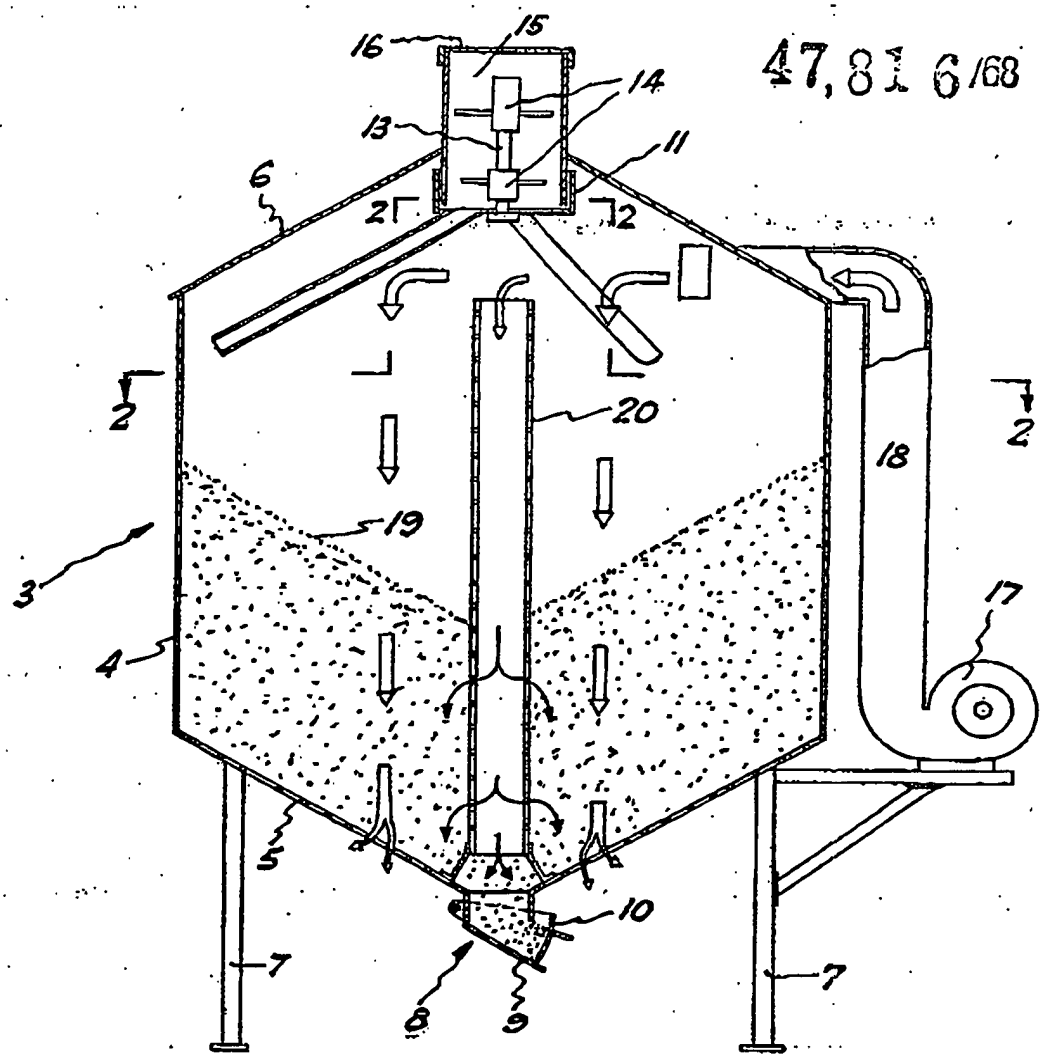

Fig.1.

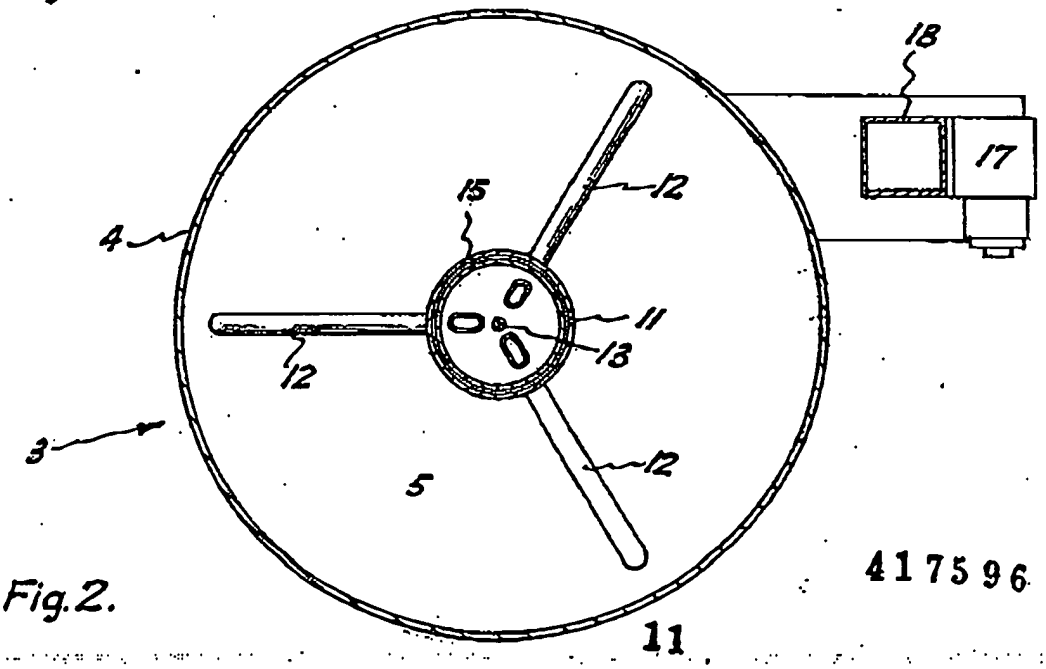

Fig.2.

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